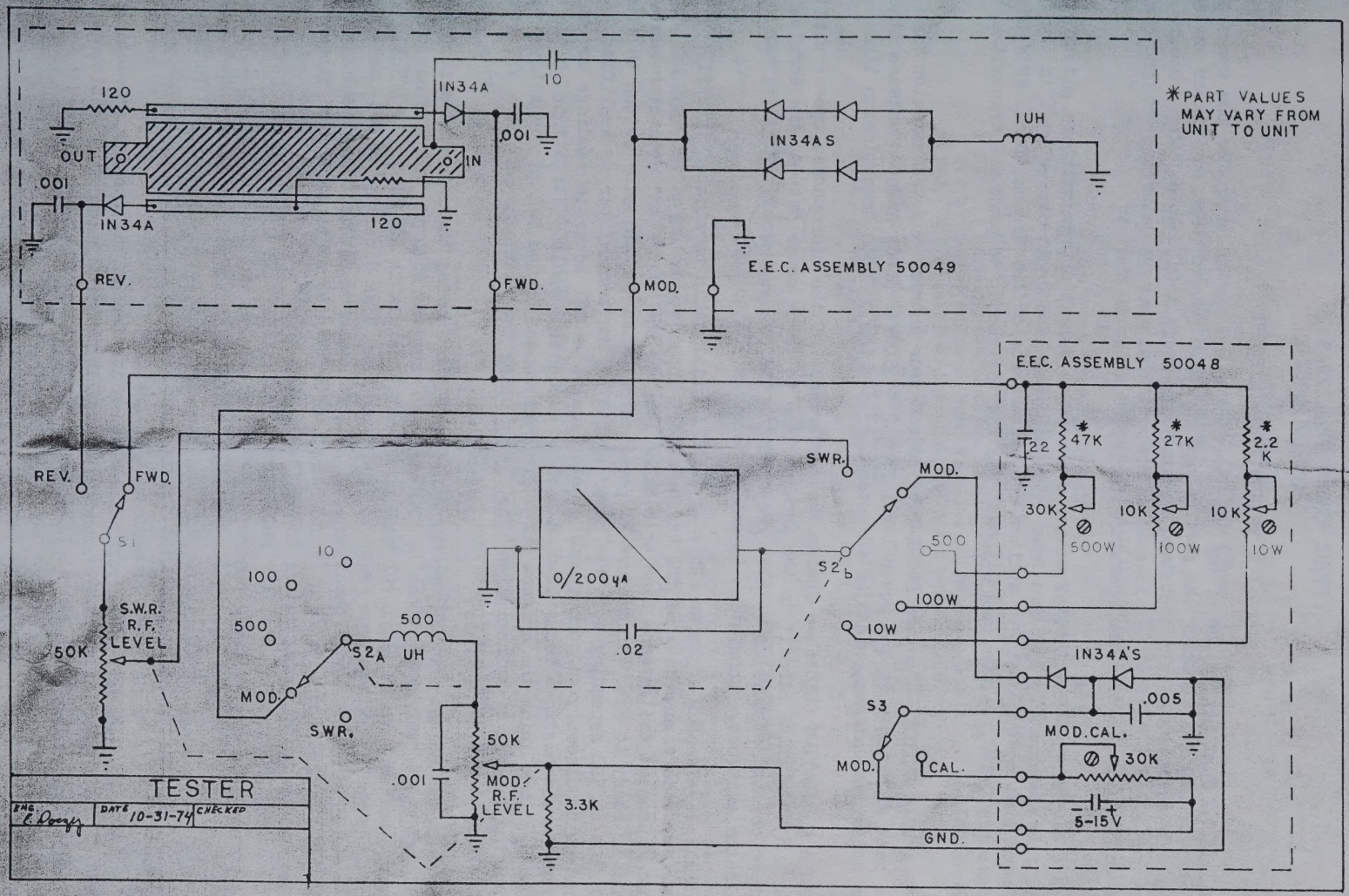

120
IN34A
10
.001
OUT
IN
.001
IN34A
120
REV.
FWD.
MOD.
IN34AS
1UH
*PART VALUES MAY VARY FROM UNIT TO UNIT
E.E.C. ASSEMBLY 50049
E.E.C. ASSEMBLY 50048
22
47K
27K
2.2 K
30K
10K
10K
500W
100W
10W
SWR.
MOD.
500
100W
10W
REV.
FWD.
S1
10
100
500
S.W.R. R.F. LEVEL
50K
500
S2A
UH
MOD.
SWR.
0/200μA
S2b
.02
IN34A'S
.005
S3
MOD.
CAL.
MOD.CAL.
30K
50K
.001
MOD. R.F. LEVEL
3.3K
5-15V
GND.
TESTER
ENG. E. Doozy
DATE 10-31-74
CHECKED

APOLLO 2400X-2

TRANSMITTER TEST SET

The 2400X-2 Test Set is one of the most versatile and useful units for the operator or service man for checking the performance of radio transmitters and linear amplifiers. The tester is self contained in one heavy guage metal cabinet with rubber feet for bench mounting. It is completely portable, uses no batteries or line cord. The unit can be used on the operating table, bench or in the car.

IT'S A WATTMETER---The 2400X-2 measures the power output of transmitters and linear amplifiers accurately when fed into a 50 ohm dummy load or it can be left in the antenna line continuously to monitor the performance of the transmitter. RF Watt ranges are 0-10W, 0-100W, and 0-500W. Use the instrument to peak all transmitter RF controls.

IT'S A VSWR BRIDGE---Use the 2400X-2 to adjust your antenna and transmission line for peak efficiency at any power level from 2 to 500W. Check unknown antenna lines for defective antenna, misadjusted antenna or shorted or open transmission line.

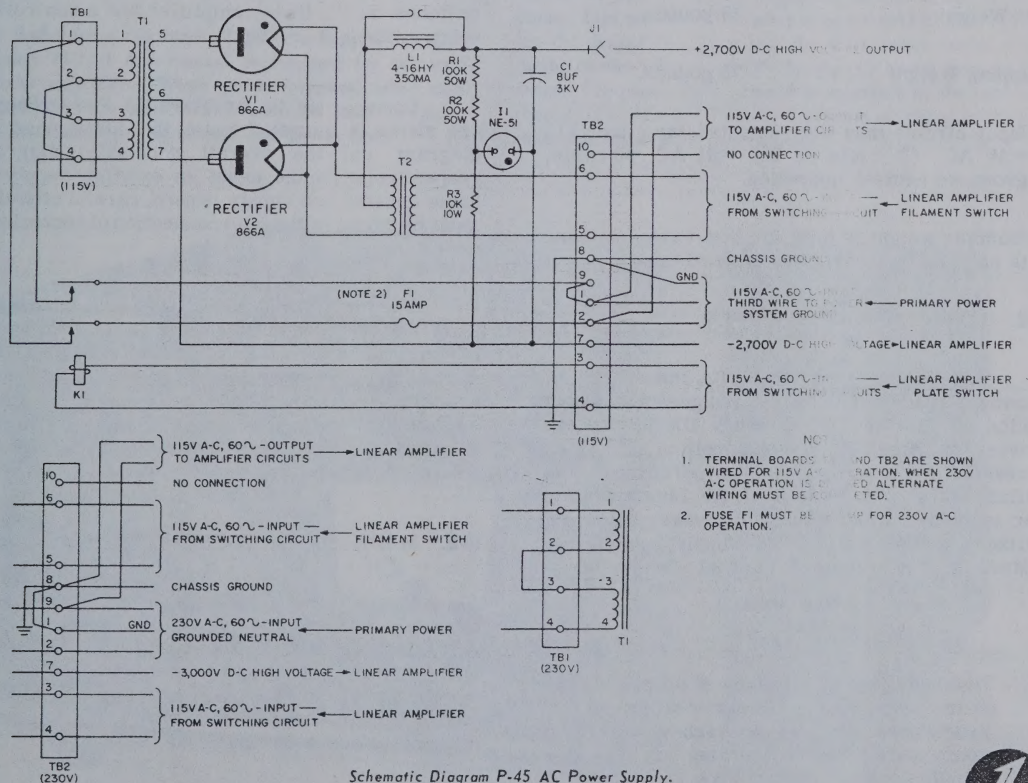
IT'S A MODULATION CHECKER---Checks the performance of the microphone, speech amplifier and modulation circuit in the antenna line to check power output, the modulation can be checked at anytime without reconnecting the cables, merely by moving the selector switches. Modulation is calibrated from 30% to 100%.

OPERATION---Connect a jumper cable of RG58U coaxial cable terminated in a P1-259 plug from the transceiver to the "transmitter" input connector on the rear of the unit. Connect the antenna line or a dummy load to the "Ant/Load" connector and the unit is ready to use. To measure RF power output move the selector switch to either 10, 100 or 500 depending upon the power rating of the transmitter or amplifier. Read watts directly on corresponding meter scale. NOTE: Accurate readings are only possible when using a Dummy Load with short connecting cable. Variations in the readings when using the antenna for a load are caused by the SWR of the antenna and changing lengths of transmission line. When using the wattmeter as above all other front panel controls are inactive.

The unit can be set for VSWR measurements merely by moving the selector switch to "SWR" and the "FWD/REV" switch to "FORWARD". Press the Push to Talk Mic button, do not talk rotate the RF level knob until meter needle is at "SET" (Full Scale). Move the rocker switch from "FWD" to "REV" and read VSWR directly on top scale. If reading is over 3 to 1 check antenna line for open or short in lead and also for good ground connections at connectors. Adjust antenna length and/or other adjustments for Minimum reading in "REV" position.
To measure Modulation, move the selector to "MOD", Move "MOD/CAL" switch to calibrate. Adjust RF level control so meter needle is on "CAL" (100%) on lowerscale when keying mic with no talking. Move switch to MOD, key mic and talk into microphone. Percentage of modulation is read directly on meter lower scale. To measure and set modulation controls in the transmitter a sine wave signal at 800 caps should be fed into the transmitter from an audio signal generator.
CALIBRATION & WARRANTY---This unit has been calibrated at the factory on each range against an accurate laboratory standard and calibration adjustment potentiometers should not be touched in the field. The unit and all parts are warrented to be free from defects for a period of 90 days after saleto user. After warranty has expired any unit may be returned to the factory for repair and recalibration for a charge of $7.00 plus parts.

PARTS LIST, POWER SUPPLY

Schematic Symbol	Description	Hallicrafters Part Number
C1	Capacitor, 8 μF, 3000V, Oil-Filled Paper	046-001[illegible]9
L1	Choke, Power, Swinging 4 to 16 H	056-000[illegible]1
J1	Connector, Single Pin, Red	010-002[illegible]7-002
E1	Cord, Power, Three-Conductor	087-008[illegible]5
F1	Fuse, Cartridge, 8 ampere, 3 AG	039-000[illegible]0
F1	Fuse, Cartridge, 15 ampere, 3 AG (alternate)	039-100[illegible]1
XF1	Fuse Holder	006-100[illegible]5
I1	Lamp, Neon, Type NE-51	039-100[illegible]9
K1	Relay, DPDT	021-000[illegible]5
P1	Plug, 3-wire AC (115 Volt)	010-002[illegible]3
P1	Plug, 3-wire AC (230 Volt)	010-002[illegible]4
R1,2	Resistor, 100K Ohm, 5%, 50 watt, wire wound	024-001[illegible]8
R3	Resistor, 10K Ohm, 5%, 10 watt, wire wound	024-001[illegible]7
XV1,2	Socket, Electron Tube, Four-Pin Ceramic	006-001[illegible]6
TB1	Terminal Board, Four double-screw type	088-000[illegible]4
TB2	Terminal Board, Ten double-screw type	088-002[illegible]4
T1	Transformer, Power Input	050-001[illegible]7
T2	Transformer, Power Output	050-001[illegible]6
V1,2	Tube, Electron, Type 866A	090-901[illegible]3



Schematic Diagram P-45 AC Power Supply.

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Printed in U.S.A.

hallicrafters

INSTRUCTION SHEET

MODEL P-45 AC POWER SUPPLY

9-1. SPECIFICATIONS.

Type of Circuit	Full-wave center tapped rectifier circuit.
Power Requirements, AC.	1200 watts, 115 volts or 230 volt 60 cycles.*
Power Output	2,700 volts DC at 375 milliamperes.
Overall Dimensions	14 inches wide x10 inches high x 12 inches deep.
Net Weight	58 pounds.
Shipping Weight	75 pounds.**

* Input circuit may be connected for either 115 volt AC, 60 cycle or 230 volt AC, 60 cycle, grounded neutral operation.

**Shipping weight is total for both cartons; cover is shipped in separate fiberboard carton.

9-2. MARK IIA POWER SUPPLY.

The Hallicrafters' Mark IIA Power Supply, shown in figures 8 and 9, is designed as a companion unit for the HT-45 Mark IIA RF Linear Power Amplifier. The power supply is sold as an accessory item to permit the purchaser of a Hallicrafters' HT-45 Mark IIA RF Linear Amplifier to choose either a matching power supply or utilize a home constructed supply, capable of delivering the required current and voltage.

WARNING

High voltages are present at all points in the power supply. Observe all safety procedures afforded to high-voltage components. Before touching any terminals in the supply, check the input power for proper disconnection and discharge the filter capacitor with a wooden stick having a metal extension capable of shorting the filter to ground.

The Mark IIA Power Supply is designed for remote operation from controls located on the front panel of the linear amplifier. The power and control lines are terminated at a ten-connector barrier-type terminal strip for ease of connection. The primary input power is terminated at these terminals and is routed to and through control circuits in the linear amplifier. The overall schematic diagram of the Model Mark IIA Power Supply is shown in figure 8.

The power supply utilizes, two type 866A, mercury vapor rectifiers in a full-wave, center-tapped circuit. The rectified output is smoothed and filtered by a wide-range swinging choke and a large value of filter capacitance. This configuration provides the static and dynamic regulation characteristics necessary. Application of primary power to the power supply is controlled by two switches on the linear amplifier and a controlled relay in the power supply.

Connections to the Mark IIA Power Supply are shown in figures 2 and 8, the interconnection diagram and the overall schematic diagram respectively. In the event an existing supply or home constructed supply is used, careful attention must be given to the interconnection of control and power lines.

The Mark IIA Power Supply may be shipped from the factory connected either for 115 volt AC or 230 volt AC, 60 cycle, single-phase, neutral-ground operation. In either event, connections for desired input source may be made by referring to figures 2 and 8 and making the alternate connections at terminal boards TB1 and TB2 of the Power Supply.

9-3. MARK IIA POWER SUPPLY, PARTS LIST.

In the event repair or replacement parts are required for the Mark IIA Power Supply, refer to the schematic diagram, figure 8, and the parts list to determine the exact replacements. In the event replacement parts are required and requests are directed to the factory, the following information must be furnished.

Model (Mark IIA, Power Supply); Serial Number; Reference Designation (e.g. R1) Description (e.g. RESISTOR, Fixed, wire wound, 100K ohms, 50W, etc.); and Part Number.

SECTION I
GENERAL DESCRIPTION

1-1. INTRODUCTION.

Radio Industries Model Mark IIA R-f Linear Amplifier, shown in figure 1, provides amplification of r-f signals in the 80 meter through 10 meter amateur bands. The amplifier uses an Eimac Type 3-400Z Zero Bias triode, in a grounded grid circuit. The linear amplifier is designed for operation with any exciter having an output impedance of 50 ohms and capable of delivering approximately 45 watts of drive.

The linear amplifier incorporates the filament supply, a cooling blower, and control circuits. Switches on the front panel provide control of: FIL-ON switch—primary power to the blower motor, the filament transformer, and external power supply filament voltage; PLATE-ON switch—power to operate a plate voltage relay in the accessory power supply.

The Radio Industries Mark IIA Power Supply, described in Section VIII of this manual, is designed for use with the linear amplifier. When power supplies, other than the Mark IIA, are used careful attention must be given to the interconnection of control and power lines.

The r-f input [illegible] of the linear amplifier utilizes a wide-band ferrite [illegible]former. The input transformer is broad-band tuned [illegible]ssentially flat from 3.5 to 30 mega[illegible] cycles. The tran[illegible]elevates the tube filament in the grounded grid ca[illegible]d provides an impedance matching circuit. The inp[illegible]edance is 50 ohms, based on the output impedance [illegible] for commercially available exciters. The driving pow[illegible]ired for 1,000 watts input to the 3-400Z tube is [illegible]mately 45 watts. However, as a result of the grou[illegible]ed circuitry, more than one-half of the driving power [illegible] through to the output and appear as useful power [illegible].

The r-f output [illegible] is a Pi-network with an operating "Q" of 12 and an [illegible]t impedance design center of 50 ohms. Taps on the [illegible]re selected by the BAND SWITCH for the desired f[illegible]y and the lever switch under the tuning control is [illegible]d ON for the 3.5 to 4.0 megacycle range. The plate [illegible]is tuned to resonance by the tuning control. The LOA[illegible] control permits matching to loads other than 50 ohm[illegible]n required.

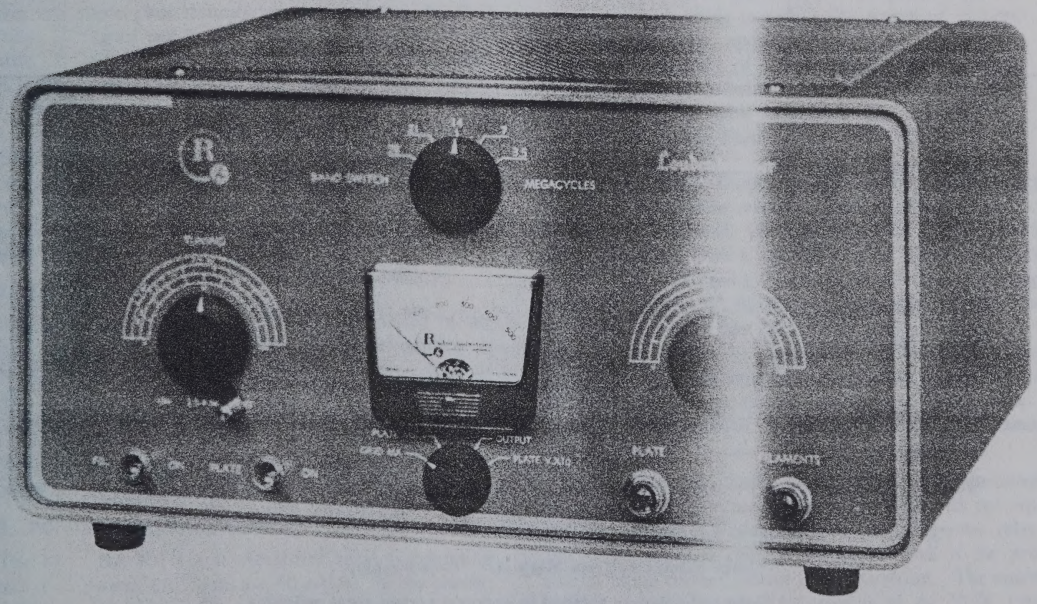


Figure 1. R-f Linear Amplifier, Model Mark IIA

1-2. TVI (TELEVISION INTERFERENCE SUPPRESSION).

Consideration has been given to minimizing possible local TVI problems in the design of the Mark IIA R-f Linear Amplifier. The unit is adequately shielded and by-passed at the r-f frequencies encountered. However, it is recommended that all station equipments be bonded together with heavy copper wire or strap and be connected to an earth ground. When bonding equipments together, care should be excercised that high impedance grounds are not encountered. To prevent high impedance grounds, avoid wire lengths which are equal to multiples of odd one-quarter wave lengths at your favorite operating frequencies.

Note

With any high power installation, particularly in television fringe areas, TVI may be a problem. Should this occur, it is recommended that a high quality, low pass filter be used at the output of the linear amplifier.

1-3. ADDITIONAL FEATURES.

The Mark IIA R-f Linear Amplifier incorporates many features for reliability and ease of operation. All important circuits are metered by a five position switch and an easily read front panel meter. The metering circuit indicates grid current, plate current, r-f output voltage, and d-c plate voltage. In the r-f OUTPUT position, the plate TUNING control is adjusted for maximum indication of r-f output voltage. A green lamp on the front panel indicates when power is applied to the filament and cooling blower. A red lamp on the front panel indicates when plate power is applied. The overall schematic diagram of the Mark IIA R-f Linear Amplifier is shown in figure 2.

SECTION II
SPECIFICATIONS

2-1. GENERAL.

Specifications for the Radio Industries Model Mark IIA R-f Linear Amplifier are presented below.

SPECIFICATIONS

Mode of Operation	Grounded grid class B linear power amplifier.
Power Requirement a-c	1500 watts, 115 volts a-c, 60 cycles*.
Power Requirement d-c	2000 volts d-c, 333 milliamperes**.
	2000 volts d-c, 400 milliamperes.
	2000 volts d-c, 400 milliamperes.
Input Impedance	50 ohms (design center)
Output Impedance	50 ohms (design center)
Driving Power for 1,000 watts input	50 watts (approximately)
Overall Dimensions	19 inches wide x 13 inches deep x 8 inches high.
Net weight	70 pounds.
Shipping weight	90 pounds.***

*Blower and filament power.

**Voltage obtainable from Mark II Power Supply.

***Tube and chimney shipped in separate carton, total weight.

SECTION III
INSTALLATION

3-1. UNPACKING.

Open ... by cutting the sealing tape and open flaps. Remove ... ing material from top and sides of carton and remove ... by lifting straight up from carton. After removing ... plifier from carton, examine carefully for any damage ... h may have occurred in shipment. Should any ... damage be apparent, file a claim with the carrier immedi... stating the extent of damage. Check and retain ... pping tags and cartons for special instructions and p... re-use. The Type 3-400Z tube and chimney are ship... in a separate carton to reduce possibility of breakag... shipment.

Note

DO ... T REMOVE TUBE AND CHIMNEY FR... CARTON UNTIL READY TO INSTALL. The ... e is installed by inserting in socket and exer... a gentle straight downward pressure on the ... e. DO NOT FORCE TUBE INTO SOC... T.

Remov... e top cover of amplifier cabinet by positioning the ... er-turn fasteners. Install the 3-400Z tube in socket ... lace glass chimney over the tube. The glass chimney ... igned and held in place by three clips on the chassis ... ify the plate lead, attached to top of r-f choke RFC1, a... plate lead to the heat radiating plate cap on the 3-400... ube. (See figure 3.) Plate lead is secured by the brass ... ew in the center of plate cap. DO NOT TIGHTEN ... CREW EXCESSIVELY, as high torque applied to the pl... cap could result in tube damage. Replace top cover of ... plifier, noting alignment of the tab which engages ... ment interlock switch, and secure in place by positioning ... he quarter-turn fasteners.

3-2. LOCATION.

It is ... important that the amplifier be placed in the operating ... sition so that unobstructed air circulation is possible ... tly behind and at the top of unit. The air intake ... e cooling blower is located at the rear of cabinet a... necessitates exhausting of the warm air out of the top ... cabinet. UNDER NO CIRCUMSTANCES SHOULD ... NY OBJECT BE PLACED ON TOP OF CABINET ... PREVENTING EXHAUST OF WARM AIR.

3-3. POWER REQUIREMENTS.

The M... IIA R-f Linear Amplifier requires operating power of ... watts, (115 volts a-c, 60 cycles) for the blower, and filam... circuits, and a plate power supply of 3,000 volts d-c a... 50 milliamperes. Input connections for power and contr... circuits are made through a multiple conductor, number c... d cable. The cable is designed to terminate at a barrier type terminal strip and a high voltage type connector on the Mark IIA Power Supply. Connections are shown in figure 4. In the event another power supply is used careful attention must be given to the interconnecting diagram and power supply schematic of figures 4 and 9, to insure proper connection.

3-4. INPUT AND OUTPUT CONNECTIONS.

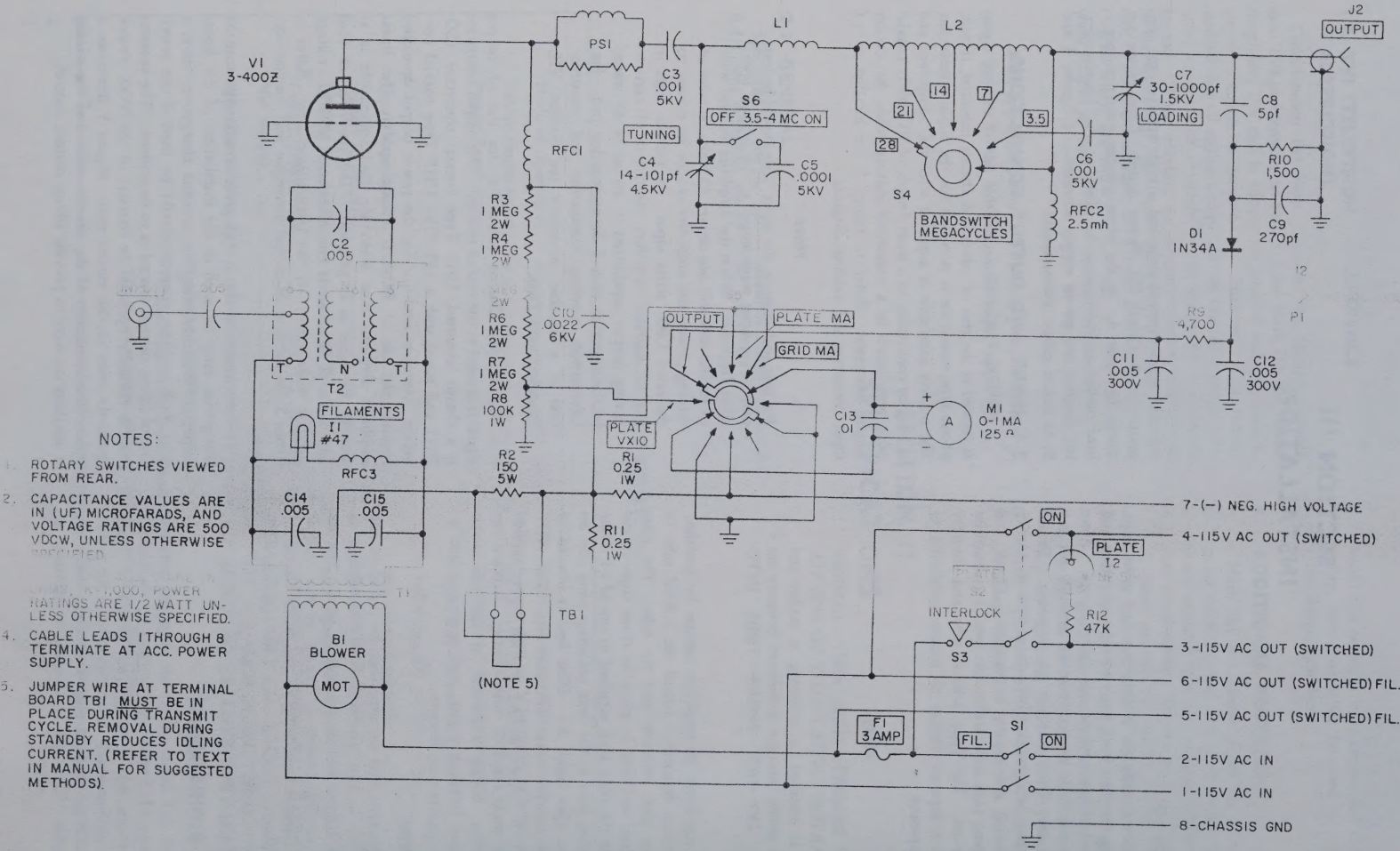
a. R-f Input. Input connection for the r-f driving signal is located at the rear of cabinet. A chassis mounted, female, phono type connector is provided for the input connection. The mating connector is supplied with the equipment and is used by connecting to a short length of RG-58/U coaxial cable terminated in a connector mating with the exciter output connector. Refer to figure 5 for location of r-f input connector and cabling diagram.

Note

For best performance, the input cable should be less than one-quarter wave-length at the highest operating frequency. When the amplifier is used with an exciter that will not deliver 45 watts or more of driving power, the amplifier cannot be driven to the rated 1,000 watts input. In certain cases it may be desirable to reduce the output of exciters having output capabilities in excess of 45 watts, by the insertion of a 3 db attenuating pad. For information covering installation and construction of a suitable attenuator see Section VII, Supplementary Data.

b. R-F Output. Output connection for the r-f output signal is located at the rear of cabinet. The output connector is a chassis mounted, UHF Type coaxial connector (SO-239) and mates with a (PL-259) UHF Type coaxial connector. Antenna feed-line for the power output developed requires the use of RG-8/U coaxial cable. The linear amplifier performs best when the load impedance is as near to 50 ohms as is practical. The condition of load impedance of 50 ohms is one of reduced VSWR (voltage standing wave ratio) on the transmission line. Refer to figure 5 for location of output connector and interconnect data.

It is recommended that a high grade coaxial type antenna changeover relay be used in the installation of the linear amplifier. When selecting the antenna changeover relay, a relay with auxiliary contacts should be used if the provision of idling current control is to be utilized. The antenna relay is normally operated by contacts of the VOX (voice operated) relay in the exciter unit. Figure 5 illustrates a typical interconnection of the antenna relay and the wiring to auxiliary contacts to provide idling current control.



NOTES:

1. ROTARY SWITCHES VIEWED FROM REAR.
2. CAPACITANCE VALUES ARE IN (UF) MICROFARADS, AND VOLTAGE RATINGS ARE 500 VDCW, UNLESS OTHERWISE SPECIFIED.
3. RESISTANCE VALUES ARE IN OHMS, K=1,000, POWER RATINGS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED.
4. CABLE LEADS 1 THROUGH 8 TERMINATE AT ACC. POWER SUPPLY.
5. JUMPER WIRE AT TERMINAL BOARD TB1 MUST BE IN PLACE DURING TRANSMIT CYCLE. REMOVAL DURING STANDBY REDUCES IDLING CURRENT. (REFER TO TEXT IN MANUAL FOR SUGGESTED METHODS).

Figure 2. R-f Linear Amplifier, Model Mark IIA, Schematic Diagram

3-5. IDLING CURRENT CONTROL CIRCUIT.

The type 3-400Z tube, a zero bias triode with operating voltages up to 3,000 volts d-c, does not require the application of bias voltage, either for normal operation or in the standby condition. However, in the standby condition with no driving signal applied, the presence of plate voltage and the heated filament permits an idling current to flow through the tube. The amount of idling current flowing in the standby condition is controlled by the resistance of the ground return circuit of the filament. Therefore, the amount of idling bias can be reduced by insertion of a resistance in the ground return circuit during standby. The resistance which is inserted during standby must be removed during the transmit condition. The two point terminal board at the rear of cabinet serves this purpose, see figure 5. The two leads terminated at the terminals provide a low resistance path and effectively removes the resistor from the circuit when auxiliary contacts of the antenna relay ci[illegible] in transmit condition or a permanent jumper is pl[illegible] across the two terminals. Idling current during st[illegible]by with the two terminals jumpered together is ap-pr[illegible]nately 120 milliamperes versus 40 milliamperes when th[illegible]mper is removed.

CAUTION

THE RESISTOR IN THE GROUND RETURN CIRCUIT MUST BE JUMPERED OR SHORTED OUT THROUGH A LOW RESISTANCE PATH DURING TRANSMIT CONDITION. FAILURE TO OBSERVE THIS CAUTION WILL RESULT IN DESTRUCTION OF THE SERIES RESISTOR.

[illegible]eration of the linear amplifier with idling current co[illegible]l circuit is optional and entirely up to the users dis-cr[illegible]n. Normal idling current of approximately 120 milli-

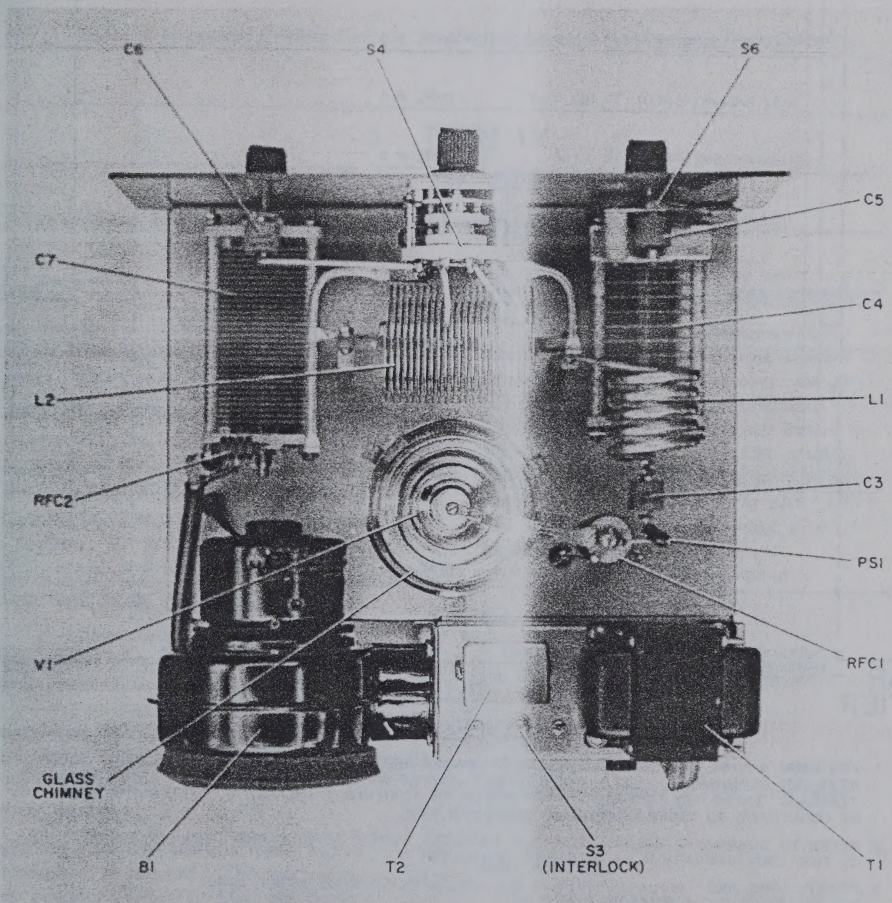
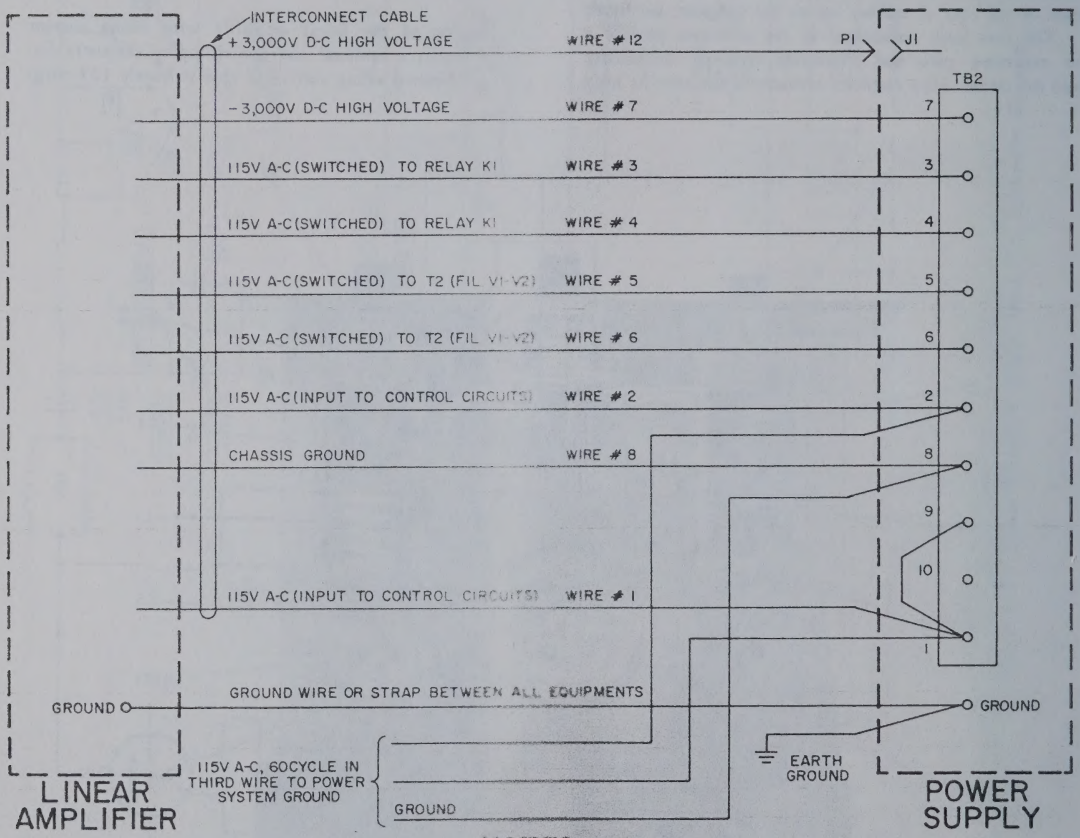


Figure 3. Top View, R-f Linear Amplifier, Mo[illegible] Mark IIA, Component Identification

amperes is not detrimental to the tube or circuit and provides a bleeder current for the Mark IIA Power Supply. The reduced idling current of approximately 40 milliamperes still provides the bleeder current for the Mark IIA Power Supply but results in reduced heat dissipation of the tube during standby condition.

If the idling current control circuit is not used, a jumper must be installed permanently across the two terminals. If the user elects to utilize the idling current control circuit, connection to the auxiliary contacts of an antenna changeover relay and the terminal strip should be made as shown in figure 5. The two leads must be connected to the auxiliary relay contacts in such a manner that when the antenna changeover relay is de-energized, standby condition, contacts are open placing the resistor in the ground return circuit, and when the antenna changeover relay is energized, transmit condition, contacts close to short the resistor out.



NOTES:

1. FOR 230V A-C, 60 CYCLE, SINGLE PHASE GROUNDED NEUTRAL OPERATION: REMOVE JUMPER WIRE BETWEEN TERMINALS 1 AND 8 AND CONNECT JUMPER WIRE BETWEEN TERMINALS 1 AND 9 ON TERMINAL BOARD TB2. CONNECT INPUT POWER TO TERMINALS 1, 8, AND 9. TERMINAL 8 MUST BE CONNECTED TO NEUTRAL (GROUND) OF POWER LINE.
2. REFER TO SCHEMATIC DIAGRAM FOR THE MARK IIA POWER SUPPLY AND CONNECT TRANSFORMER T1 FOR 230V OPERATION AT TERMINAL BOARD TB1.
3. POWER CORD AND TWO A-C POWER PLUGS ARE SUPPLIED WITH POWER SUPPLY.

Figure 4. Interconnect Diagram, R-f Linear Amplifier to Accessory Power Supply, Mark IIA

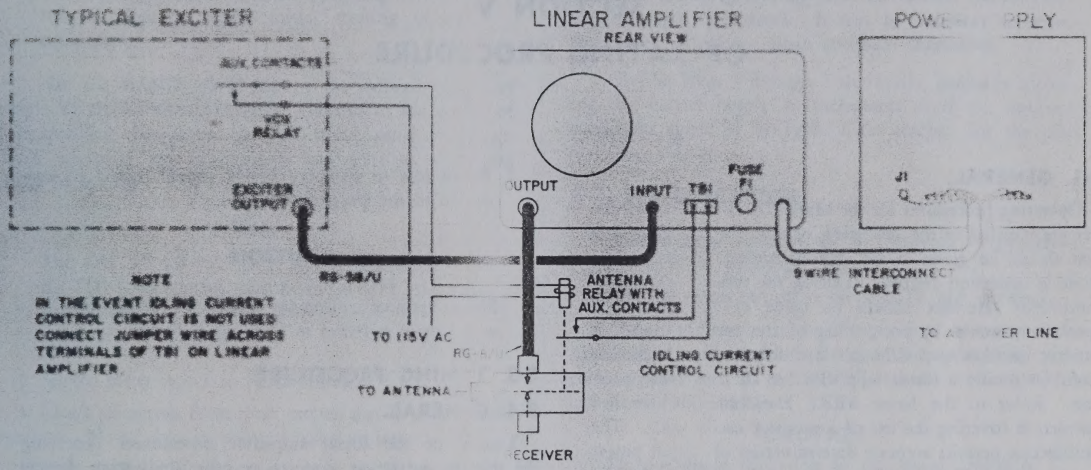


Figure 5. Suggested Cabling Diagram for Exciter, Linear Amplifier, and Power Supply

SECTION IV
FUNCTION OF OPERATING CONTROLS

4-1. GENERAL.

Operating controls for the Linear Amplifier and [illegible]te operation of the accessory Power Supply, are all loca[illegible]on the front panel. (See figure 1.)

4-2. FILAMENT SWITCH.

The FILAMENT switch, a two position (on-off [illegible]gle switch, applies power to the filament and blower [illegible]he amplifier and a-c power to the filament transformer [illegible]he rectifier tubes in the accessory power supply, when [illegible]ed in the ON position. The green lamp indicates when [illegible]ch is in the ON position, and voltage is applied.

4-3. PLATE VOLTAGE SWITCH.

The PLATE voltage switch, a two position (co[illegible]f) toggle switch, applies plate voltage to the Linear Am[illegible]er through relay control circuits incorporated in the [illegible]rk IIA Power Supply, or other similar power supply. T[illegible]d lamp indicates when the plate switch is in the ON p[illegible]on and primary power is applied to the plate transfor[illegible]in the accessory power supply.

4-4. METER SWITCH.

The Meter Switch, a five position rotary switch, [illegible]rs the desired circuit to be metered. The operator may [illegible]ct GRID MA (current), PLATE MA, off position [illegible]ot marked), r-f OUTPUT voltage or PLATE VX10 (volt[illegible]). The center position (not marked) removes the meter [illegible]m transmitter circuitry providing an off position.

4-5. BAND SWITCH—MEGACYCLES.

The BAND SWITCH-MEGACYCLES, [illegible]e position rotary switch, selects the desired amateur [illegible], indicated in megacycles. This switch selects the prope[illegible]aps on the coil and additional tuning capacitance for [illegible]d changes. The ON 3.5-4.0 MC OFF switch located un[illegible] the TUNING control must be in the ON position [illegible]5-4.0 MC (80 meter band) operation only. This swit[illegible]places additional padder capacitance in the plate tuning [illegible]rcuit. The ON 3.5-4.0 MC OFF switch *must be in th*[illegible]*F* position for all other operating frequencies.

4-6. PLATE TUNING.

The plate TUNING control, a variable c[illegible]tor resonates the plate circuit at the desired frequenc[illegible].

4-7. PLATE LOADING.

The plate LOADING control, a variable c[illegible]tor, adjusts the transformer ratio of the Pi-network [illegible]reflect the desired load to the tube.

4-8. METER.

The meter provides an indicator for tuni[illegible] the amplifier. The meter indicates grid current (0 [illegible]00 MA.), plate current (0-500 MA) r-f output voi[illegible] (arbitrary scale) and plate voltage (0 to 500 volts x 1[illegible]

SECTION V

OPERATING PROCEDURE

5-1. GENERAL.

Operating procedures for the Mark IIA R-f linear Amplifier are covered in the following paragraphs. Careful attention should be given to the various tuning procedures for mode of operation desired. During the tune-up procedures continuous reference should be made to the meter and operation checked by positioning of the meter switch. A monitor oscilloscope, although not required, is extremely useful in tuning a linear amplifier for all modes of operation. Refer to the latest ARRL Handbook for detailed instruction covering the use of a monitor oscilloscope. The oscilloscope permits accurate determination of output power in any mode. The metering circuit will establish the d-c input power during tune-up procedures, and the average power when transmitting in the single sideband or AM (amplitude modulated) voice modes. There are many factors which influence the ability of a meter to indicate the power input in voice modes of operation. Some of these are the degree of damping in the meter, individual voice characteristics, microphone frequency response, exciter audio bandwidth, etc. Typical meter reading in normal SSB (single sideband) operation will be approximately 175 milliamperes on voice peaks when set to the PLATE MA (current) position.

5-2. PRELIMINARY PROCEDURES.

Before operation or tune-up is attempted the following must be checked and completed:

1. All power connections and control lines to external power supply must be made in accordance with information contained in Section III.
2. All station equipments should be bonded together and connected to an earth ground.
3. The output of linear amplifier must be connected to a 50 ohm antenna load or a dummy load capable of dissipating the output power. Connection to antenna should be made using Type RG-8/U coaxial cable. DO NOT ATTEMPT TO OPERATE OR TUNE THE LINEAR AMPLIFIER WITHOUT A SUITABLE LOAD CONNECTED TO THE OUTPUT.
4. A source of r-f driving power must be connected to the r-f input connector through a length of coaxial cable.
5. The antenna changeover relay should be in the antenna transmission line and the idling current control circuits should be connected to the changeover relay or be shorted out permanently by a jumper as covered in Section III.
6. The FILament and PLATE switches must be in their OFF positions. Top cover of amplifier must be in place and secured to complete interlock circuit.
7. Power line to accessory power supply should be connected to the a-c power line.

CAUTION

Never connect equipment to the a-c power line with power switches in their on positions.

5-3. TUNING PROCEDURE.

5-4. GENERAL.

Tuning of the linear amplifier necessitates observing the relative output at a meter or other indicating device. This is characteristic of all linear amplifiers for they do not exhibit as pronounced a dip at resonance as a class C amplifier. The power input at resonance is dependent upon the r-f driving power applied and the loading. After the linear amplifier is properly resonated and loaded, output power may be reduced by decreasing the exciter output.

Note

When tuning the Mark IIA R-f Linear Amplifier it is important that the plate TUNING and LOADING controls be pre-set to the panel marking of the controls for the frequency of operation desired. Subsequent adjustments are made with the TUNING control for maximum r-f power as indicated by the meter with meter switch set to the output position. The plate LOADING control is adjusted for proper loading in accordance with Table II.

5-5. TUNING PROCEDURE.

The following steps apply to all modes of operation and should be completed before tune-up for a specific mode is attempted.

1. Place the FILament switch in the ON position to apply voltage to the blower and filament circuits of the linear amplifier and the accessory power supply rectifier filament transformer when using the Radio Industries Mark IIA Power Supply. The green lamp indicates application of power to the above circuits.

Note

Allow a minimum of four minutes for filament warm-up before applying plate voltage. When using the Mark IIA Power Supply the delay permits mercury vapor rectifier tubes to reach proper operating temperature. In the event prolonged periods of time have elapsed between operating times, a fifteen minute delay to permit

mercury vapor tubes to reach operating temp ture is desirable upon initial starting of equipment.

2. Set the BAND SWITCH to the desired fr ncy range, TUNING and LOADING controls to the co of corresponding frequency on the front panel m gs. These markings are approximate and serve as a ing point in tuning.

Note

The ON 3.5-4.0 MC OFF switch located un the TUNING control, must be in the OFF posi for all frequencies other than 3.5-4.0 MC (meter band) operation.

3. Set the meter switch to PLATE MA.

4. Check r-f output control on exciter that it is i off position. No r-f driving power applied to input.

5. Place the PLATE voltage switch in the ON pos

6. Observe the meter for indication of idling nt, (meter switch in PLATE MA position). When ng the idling current control circuit as suggested ce idling current, the auxiliary contacts on antenna ge- over should be open (de-energized) and the idlin ent as indicated by meter will be approximately 40 milli es. If the idling current control circuit suggested is u sed a permanent jumper wire must be in place across wo screw terminals at rear of cabinet and the meter w di- cate approximately 120 milliamperes of idling cur

7. Set the meter switch to PLATE VX10 posi nd note indication on meter for reference in tune-up pr es of paragraph 5-6 and Tables I and II.

5-6. CW OPERATION.

1. Assuming the filament and plate voltages ha een applied by completing steps 1 through 7 of pr ing paragraph 5-5, set meter to PLATE MA, incre the r-f output of the exciter in the CW mode (con ous carrier) until the meter on the Mark IIA R-f Linear pli- fier indicates approximately 200 milliamperes.

2. Set the meter switch to OUTPUT position a just plate TUNING control for resonance, upward d ion of the meter.

3. Increase excitation (check resonance each the drive is changed) until either the plate or grid of Table I is reached.

4. Set the meter switch to GRID MA position an rve grid current for comparison with Table I.

5. In the event the plate current is less than liste the corresponding grid current obtained during tun the amplifier is not loaded to optimum condition. ase loading by rotating plate LOADING control coun ck- wise in small increments. It may be necessary to ase the exciter output to obtain optimum conditions.

If the plate current is more than listed for th re- sponding grid current, the amplifier is loaded to vy. Decrease loading by rotating plate LOADING control cloc wise in small increments. It may be necessary to redu the exciter output to obtain optimum conditions.

6. Repeat steps 3 through 5 alternately, gradually increas ing the exciter output in increments until the optimu conditions specified in Table I are reached for the plat operating voltage.

5-7. SSB OPERATION.

1. Follow steps 1 through 7 as described in paragraph 5-5 and steps in paragraph 5-6.

2. Set the meter switch to the PLATE MA position.

3. Switch the exciter to the SSB position and adjust audio gain control until the Mark IIA R-f Linear Amplifier plat current peaks at 170 to 200 milliamperes while speakin in a normal tone of voice.

CAUTION

Do not apply excitation to the linear amplifier without plate voltage applied to the 3-400Z.

TABLE I.
OPTIMUM VOLTAGE AND CURRENT RATIOS

Plate Voltage PLATE VX10	Plate Current PLATE MA	Grid Current GRID MA
300	333	150
250	400	165
200	400	168

5-8. AM OPERATION.

1. Follow and complete steps 1 through 7 of paragraph 5-5.

2. Set the meter switch to the PLATE MA position.

3. Switch the exciter to the AM (DSB) position an adjust the exciter output until the plate current meter ind cates plate voltage and current ratio of Table II, for th applied operating voltage.

5-9. VOICE OPERATED BREAK-IN (VOX).

When the exciter utilizes voice operated break-in (VOX the PLATE switch is left in the ON position. The antenn relay is actuated by the VOX relay to transfer the antenn and close the auxiliary contacts on the antenna relay.

5-10. CALCULATING POWER INPUT.

To determine the average d-c plate power input, multipl the plate current by the voltage indicated by the meter i the PLATE VX10 position (333 MA x 300 x 10—99 watts).

Meter readings will be accurate only when a steady CW input is being measured. As previously mentioned, man factors influence the indicated plate current on SSB.

TABLE II.

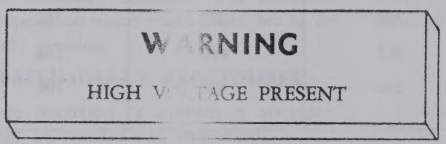
AM MODE PLATE VOLTAGE AND PLATE CURRENT RATIO

Plate Voltage PLATE VX10	Plate Current PLATE MA
300	200
250	240
200	300

SECTION VI
SERVICE DATA

6-1. WARNING HIGH VOLTAGE.

D-c voltages in excess of 3,000 volts are present in the linear amplifier and accessory power supply. *DO NOT* attempt to measure voltages with hand-held test leads or to service this amplifier with the high voltage supply on. In addition to the danger of serious injury or death from the high voltage supply, serious radio frequency burns can result from coming in contact with or in close proximity to the plate and output circuits.



6-2. CLEANING.

Equipment utilizing forced air cooling will collect dust within the unit, depending on the dust content of the circulated air.

All components should be kept clean, as any accumulation of dust in the high voltage or r-f areas may cause arcing and consequent damage.

CAUTION

When cleaning the variable capacitors, use care so as not to nick or bend capacitor plates. Never use solvents for cleaning any component or area of the unit. The preferred method of cleaning is the use of a vacuum cleaner while dusting with a clean, flexible, bristle brush.

6-3. LUBRICATION.

Lubricate the blower every six months with a few drops of SAE No. 10 oil at the front and rear oil retainers. Do not over lubricate.

6-4. SERVICE OR OPERATION QUESTIONS.

For further information regarding operation or servicing of the Mark IIA R-f Linear Amplifier, contact Radio Industries, Inc. by letter requesting the desired information. Shipments to the factory must be authorized by letter, as Radio Industries will not accept the responsibility for unauthorized shipments of equipment or parts for service or replacement.

Radio Industries reserves the privilege of making revisions in current production of equipment and assumes no obligation to incorporate these revisions in earlier models.

SECTION VII
SUPPLEMENTARY DATA

7-1. NEUTRALIZATION.

Neutralization of the triode stage is not necessary. Grounded grid operation, low impedance input, and excellent shielding and bypassing assures complete stability at all times.

7-2. GRID CURRENT

Grid current will be approximately 0 to 75 milliamperes on SSB voice peaks. Under no circumstances should the grid current be allowed to exceed 200 milliamperes.

Note

Excitation should always be removed from the amplifier before the PLATE voltage switch is placed in the off position.

7-3. R-F OUTPU VOLTMETER.

The r-f output vo eter is connected across the r-f output connector and i ates output voltage. This meter is not calibrated to re ctual power but is merely a tuning indicator. Always t e for maximum voltage reading for a given plate curren th proper grid current, as this is not a peak reading voltm r, voice peaks will deflect the meter approximately one-th of the equivalent CW output.

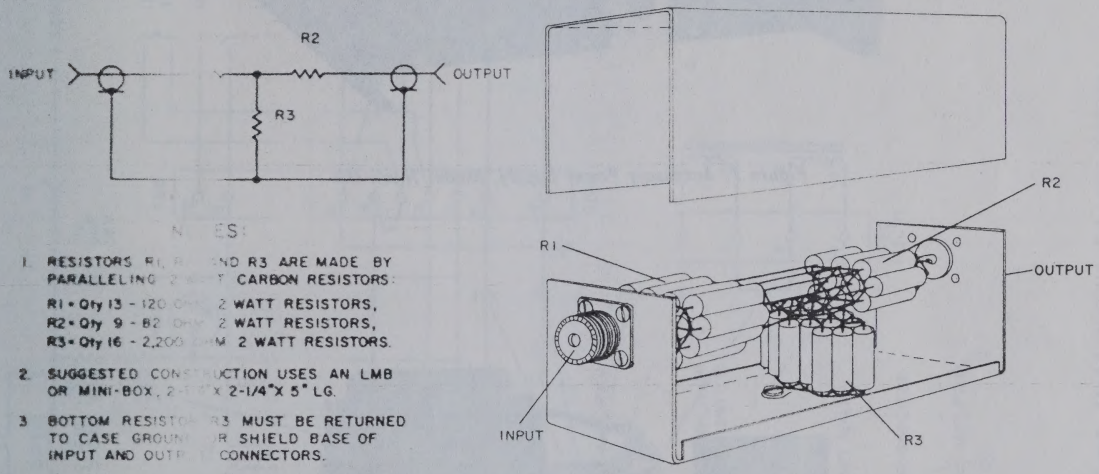
7-4. CONSTRUCTION AND USE OF AN INPUT ATTENUATOR PAD.

If the exciter use to drive the Mark IIA R-F Linear Amplifier has an ou ut of 100 watts, the use of a 50 ohm 3 db attenuator d between the output of exciter and the input of the linear amplifier will simplify the tune-up and operation of both equipments.

Construction details and the input and output connections of a suitable 50 ohm 3 db attenuator pad are given in figure 6. Care should be taken in construction if other values are used to obtain the required resistances that the power ratings of selected resistors are not exceeded.

7-5. TUBE COOLING.

A fifty cubic foot per minute blower pressurizes the bottom of the chassis. The air flow is directed around the 3-400Z tube, through the chimney and out through the top of the unit. Never operate the amplifier with the blower inoperative, or with the chimney removed.



N ES:

1. RESISTORS R1, R ND R3 ARE MADE BY PARALLELING 2 T CARBON RESISTORS:
   R1 • Qty 13 - 120 O 2 WATT RESISTORS,
   R2 • Qty 9 - 82 OH 2 WATT RESISTORS,
   R3 • Qty 16 - 2,200 M 2 WATT RESISTORS.
2. SUGGESTED CON CTION USES AN LMB OR MINI-BOX, 2- X 2-1/4"X 5" LG.
3. BOTTOM RESISTO 3 MUST BE RETURNED TO CASE GROUN R SHIELD BASE OF INPUT AND OUTP CONNECTORS.

Figure 6. Suggested 50-ohm 3 db Attenuator Pad

SECTION VIII
ACCESSORY ITEMS

8-1. GENERAL.

The companion er supply manufactured by Radio Industries is cove n this section for information purposes.

8-2. MARK IIA OWER SUPPLY.

The Radio Indus s Mark IIA Power Supply, shown in figures 7 and 8 designed as a companion unit for the Mark I, II and R-f Linear Power Amplifiers. The power supply is so as an accessory item to permit the purchaser of a Radi Industries Mark IIA R-f Linear Amplifier to choose eit a matching power supply or utilize a home constructed upply, capable of delivering the required current and oltage.

WARNING

High voltages are present at all points in the power supply. Observe all safety procedures afforded to high voltage components. Before touching any terminals in the supply check input power for proper disconnection and discharge filter capacitor with a wooden stick having a metal extension capable of shorting the filter to ground.

The Mark IIA Power Supply is designed for remote operation, from controls located on the front panel of the Mark IIA R-f Linear Amplifier. The power and control lines are terminated at a (10) ten point barrier type

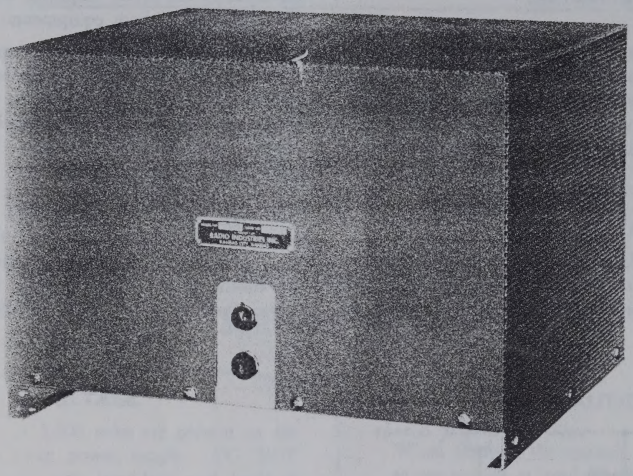


Figure 7. Accessory Power Supply, Model Mark IIA

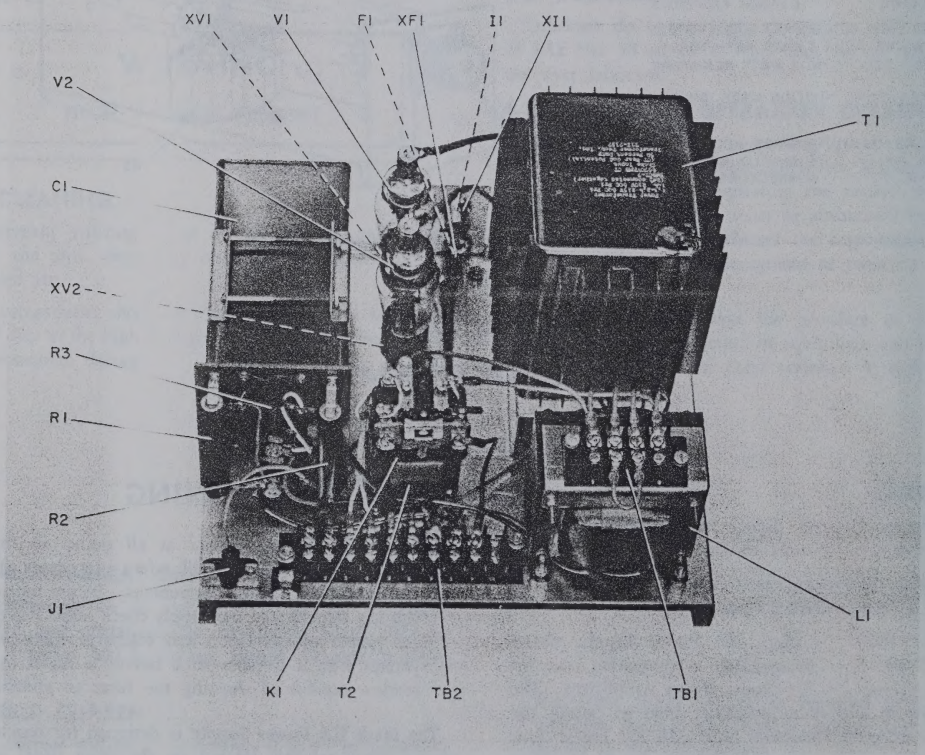


Figure 8. Accessory Power Supply, Model Mark IIA, Component Location Cover Removed

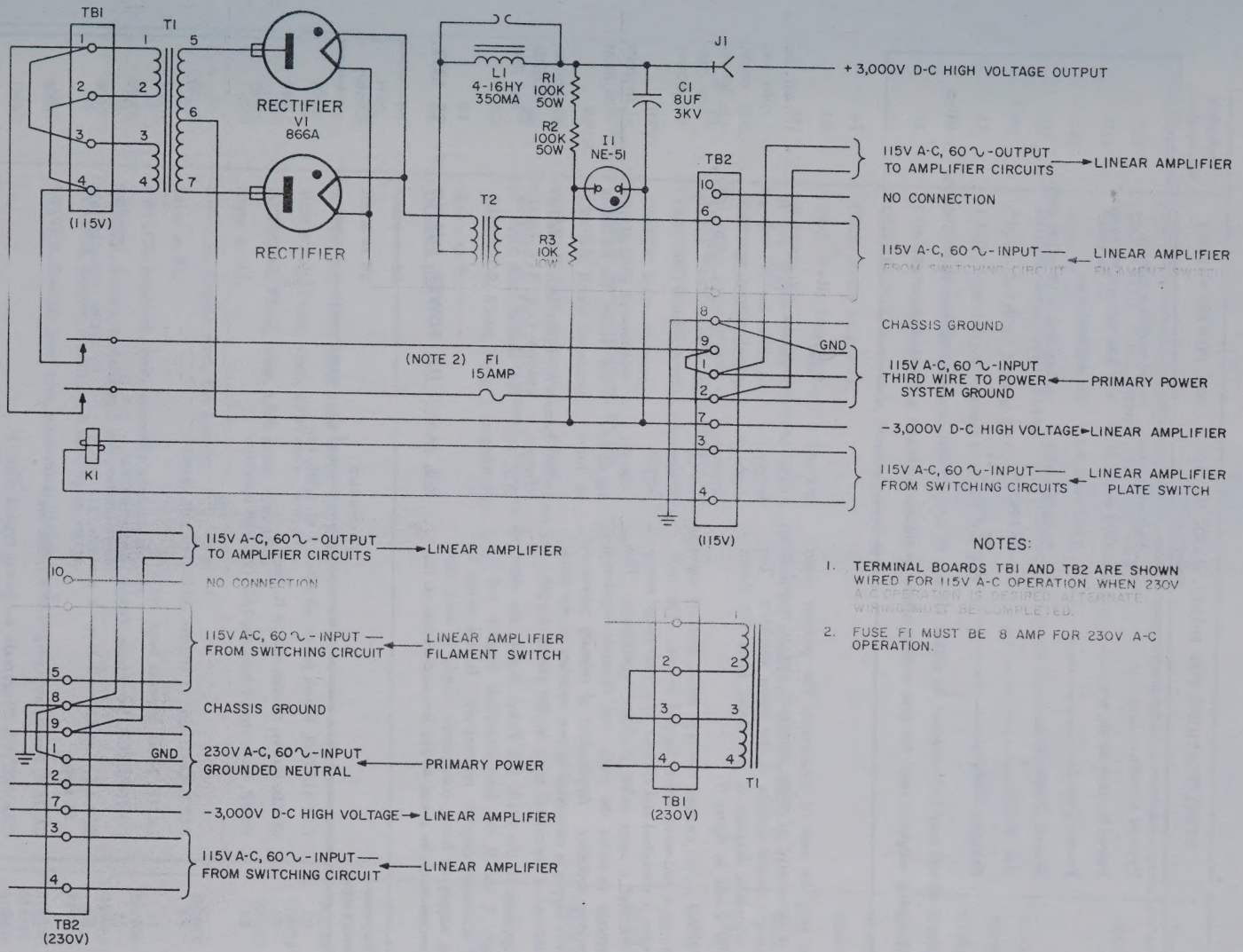


Figure 9. Power Supply, Model Mark IIA, Schematic Diagram

SPECIFICATIONS FOR MODEL MARK IIA ACC[illegible]RY POWER SUPPLY

Type of Circuit	Full-wave cent[illegible]pped rectifier circuit.
Power Requirements, a-c	1200 watts, 115 [illegible] or 230 volt a-c, 60 cycles.*
Power Output	3,000 volts d-c [illegible] 50 milliamperes.
Overall Dimensions	14 inches wide [illegible] inches high x 12 inches deep.
Net Weight	58 pounds.
Shipping Weight	75 pounds.**

* Input circuit may be connected for either 115 a-c, 60 cycle or 230 [illegible] a-c, 60 cycle, grounded neutral [illegible]ation.

**Shipping weight is total for both cartons; cover is shipped in sepa[illegible] fiberboard carton.

terminal strip for ease of connection. The primary input power is terminated at these terminals and is routed to and through control circuits in the linear amplifier. The overall schematic diagram of the Model Mark IIA Power Supply is shown in figure 9.

The power supply utilizes two type 866A, mercury vapor [illegible] rectifiers in a full-wave center tapped circuit. The rectified output is smoothed and filtered by a wide-range swinging choke and a large value of filter capacitance. This configuration provides the static and dynamic regulation characteristic necessary. Application of primary power to the power supply is controlled by two switches on the linear amplifier and a controlled relay in the power supply.

Connections to the Mark IIA Power Supply are shown in figures 4 and 9, the interconnection diagram and the overall schematic diagram respectively. In the event an existing supply or home constructed supply is used, careful attention must be given to the interconnection of control and [illegible]r lines.

The M[illegible]IIA Power Supply may be shi[illegible] from the factory co[illegible]ted either for 115 volt a-c o[illegible] volts a-c, single ph[illegible] neutral ground operation. I[illegible]her event, connecti[illegible] desired input source may b[illegible]de by referring t[illegible]ures 4 and 9 and making th[illegible]nate connections [illegible]rminal boards TB1 and TB[illegible]he Power Supply.

In the [illegible] replacement parts are requir[illegible]d requests are direc[illegible] the factory, the following inf[illegible]tion must be furnis[illegible]

Model [illegible]eries (e.g. Mark II, IIA, etc.)[illegible]l number; reference [illegible]gnation (e.g. R1) Description [illegible].g. RESISTOR, Fix[illegible] wire wound, 100k ohms, 50w.[illegible] and Part Number.

8-3. MARK IIA POWER SUPPLY, PARTS LIST.

Reference Designation	Description	Part Number
C1	CAPACITOR, Fixed, paper, oil filled, 8 uf, 3,000, vdc	90000
E1	CORD, Power, 3 conductor, 8 ft. long.	21040
F1	FUSE, Cartridge, 8 ampere, 3AG (230 volt operation)	00081
	OR	
F1	FUSE, Cartridge, 15 ampere, 3AG (115 volt operation)	00150
I1	LAMP, Neon, bayonet base, NE-51.	10051
J1	CONNECTOR, Receptacle, female, single pin, red.	30009
K1	RELAY, Armature, 2 form A contacts, 115 volt a-c [illegible]l, 60 cycles, contacts rated 25 amps.	50040
L1	CHOKE, Power, swinging, 4-16 hy, 350 ma.	90005
P1	CONNECTOR, Plug, male, a-c power type, 3 wire 115 [illegible]	32041
	AND	
P1	CONNECTOR, Plug, male, a-c power type, 3 wire 230 [illegible]	32042

Reference Designation	Description	Part Number
C13	CAPACITOR, Fixed, ceramic, .01uf, 300 vdcw.	750103
C14	Same as C1.	
C15	Same as C1.	
D1	DIODE, Germanium, IN34A.	400034-1
F1	FUSE, Cartridge, 3 Amp, 3AG.	600030
I1	LAMP, Incandescent, bayonet base, 6-8 volt #47.	210047
I2	LAMP, Neon, bayonet base, NE-51H.	210051-8
J1	CONNECTOR, Receptacle, female, chassis mtg, phono type.	233040
J2	CONNECTOR, Receptacle, female, coaxial type.	230008
L1	COIL, Radio frequency.	320030
L2	COIL, Radio frequency.	
M1	METER D'Arsonal movement, 0-1 MA, 125 ohm d-c resistance, 0-500 scale, 2-½ in × 3 inch.	630040
PSI	SUPPRESSOR, Parasitic.	350040
P1	CONNECTOR, Plug, male, phono type.	232040
P2	CONNECTOR, Plug, male, single pin, red.	232009
RFC1	CHOKE, Radio frequency.	330015
RFC2	CHOKE, Radio frequency, 2.5 mh.	330013
RFC3	CHOKE, Radio frequency.	330014
R1	RESISTOR, Fixed, wire wound, 0.25 ohms, 1w, 1%.	160001
R2	RESISTOR, Fixed, wire wound, 150 ohms, 5w, 5%.	146151
R3	RESISTOR, Fixed, comp, 1 meg ohm, 2w, 10%.	104105
R4	Same as R3.	
R5	Same as R3.	
R6	Same as R3.	
R7	Same as R3.	
R8	RESISTOR, Fixed, comp, 100K ohms, 1w, 10%.	103104
R9	RESISTOR, Fixed, comp, 4,700 ohms, ½w, 5%.	112472
R10	RESISTOR, Fixed, comp, 1,500 ohms, ½w, 10%.	102152
R11	Same as R1.	
S1	SWITCH, Toggle, dpst, bat handle.	240300
S2	Same as S1.	
S3	SWITCH, Interlock, Push, normally open, single pole.	240500
S4	SWITCH, Rotary, 6 position, 1 pole, ceramic wafer.	240001
S5	SWITCH, Rotary, 5 position, 2 pole, nylon wafer.	240000
S6	SWITCH, Special, lever type, mechanical linkage, three parts. A B C	010300 010301 010302
TB1	BOARD, Terminal, 2 screw terminals.	590001

Reference Designation	Description	Part Number
R1	**RESISTOR, Fixed, wire wou** 100K ohms, 50w, 5	149104
R2	**Same as R1.**	
R3	**RESISTOR, Fixed, wire wou** 10K ohms, 10w, 5	147103
TB1	**BOARD, Terminal, 4 double** ew terminals.	590002
TB2	**BOARD, Terminal, 10 doubl** rew terminals.	590003
T1	**TRANSFORMER, Power,** p, dual primary 2-4, 115v a-c 60 cycles, 1-4 230v a-c 60 cycles, 2 co ted to 3. Seconda 6575 volts rms center tapped 350 ma d-c.	390000
T2	**TRANSFORMER, Power** down, 115 volt a- 0 cycle, primary. 2.5 volt a-c secondary, 10 amps.	390004
XF1	**FUSEHOLDER, Extractor** type.	231040
XV1	**SOCKET, Tube, 4 pin cera**	233041
XV2	**Same as XV1.**	

SECTION IX
PARTS LIST

9-1. GENERAL.

In the event repair or replacement parts are required for the Mark IIA R-f Linear Amplifier, refer to the schematic diagram figures 2 and 10 and parts list to determine the exact replacement. Parts orders directed to the factory must provide the following information: Reference Designation (e.g. R1); Description (e.g. RESISTOR, Fixed, comp, k ohms, 1w, 10%); Part Number and the Serial Numb

9-2. PARTS LIST.

Reference Designation	Description	Part Number
B1	**BLOWER, Centrifugal, 50** ft. per min., 1550 M, 115 v a-c 60 cycle.	690000
C1	**CAPACITOR, Fixed, mica,** uf, 500 vdcw, 20%, 35 Case Style.	717502
C2	**Same as C1.**	
C3	**CAPACITOR, Fixed, ceram** 01uf, 5,000 vdcw.	790001
C4	**CAPACITOR, Variable, Air** ectric, 16-101 pf 4,5 vdcw.	850001
C5	**CAPACITOR, Fixed, ceram** 001 uf, 5,000 vdcw.	790002
C6	**CAPACITOR, Fixed, ceram** 01uf, 5,000 vdcw.	790003
C7	**CAPACITOR, Variable, Air** ectric, 30 to 1000 pf ,500 vdcw.	850002
C8	**CAPACITOR, Fixed, mica, 5** 500 vdcw, 20%, CM Case Style.	715050
C9	**CAPACITOR, Fixed, mica, 2** f, 500 vdcw, 20%, 20 Case Style.	715271
C10	**CAPACITOR, Fixed, ceram** 022uf, 6,000 vdcw, 2 .	790004
C11	**CAPACITOR, Fixed, ceram** 05uf, 300 vdcw, 20	750502
C12	**Same as C11.**	

Reference Designation	Description	Part Number
T1	TRANSFORMER, power, step-down 115 v a-c, 60 cycle primary, 5.5 v a-c 15 amp secondary.	39000
T2	TRANSFORMER, radio frequency, input.	32002
V1	TUBE, electron 6Z Triode.	20340
XF1	FUSEHOLDER, fuse, post type.	23104
XI1	INDICATOR, with jewel.	58000
XI2	INDICATOR, with jewel.	58000
XV1	SOCKET, Electron tube.	23304
	CHIMNEY, Tube.	57000
	Instruction Manual	97007

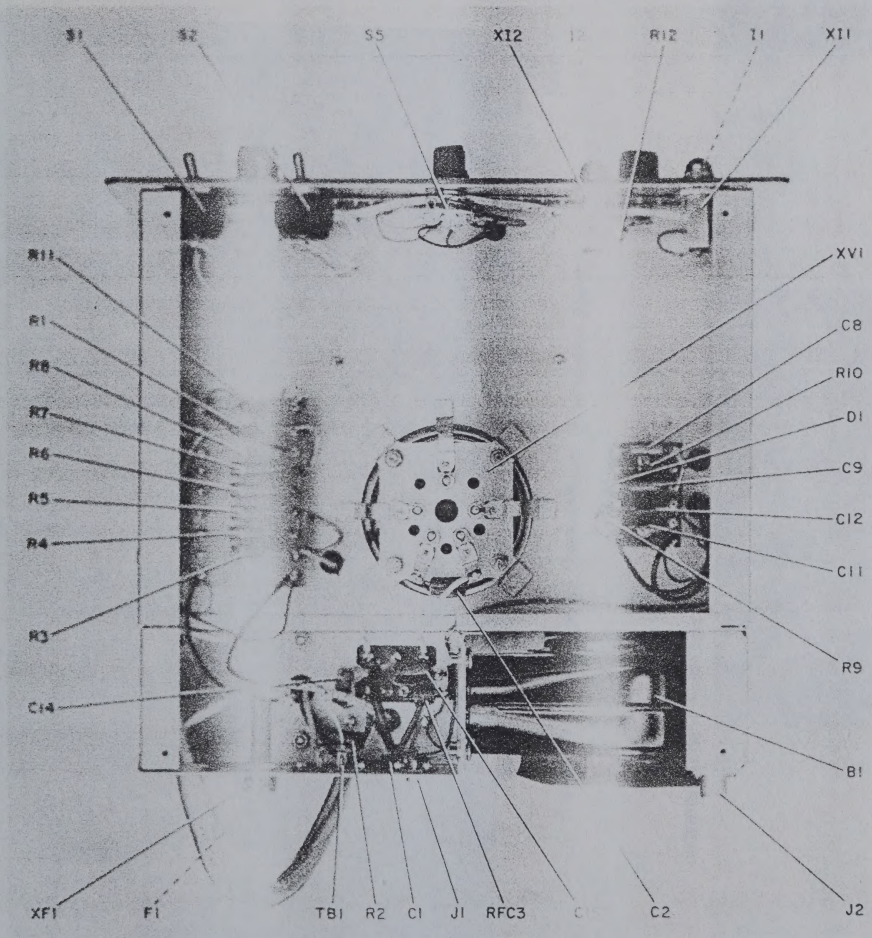


Figure 10. Bottom View, R-f Linear Amplifier, Model Mark [illegible], Component Identification

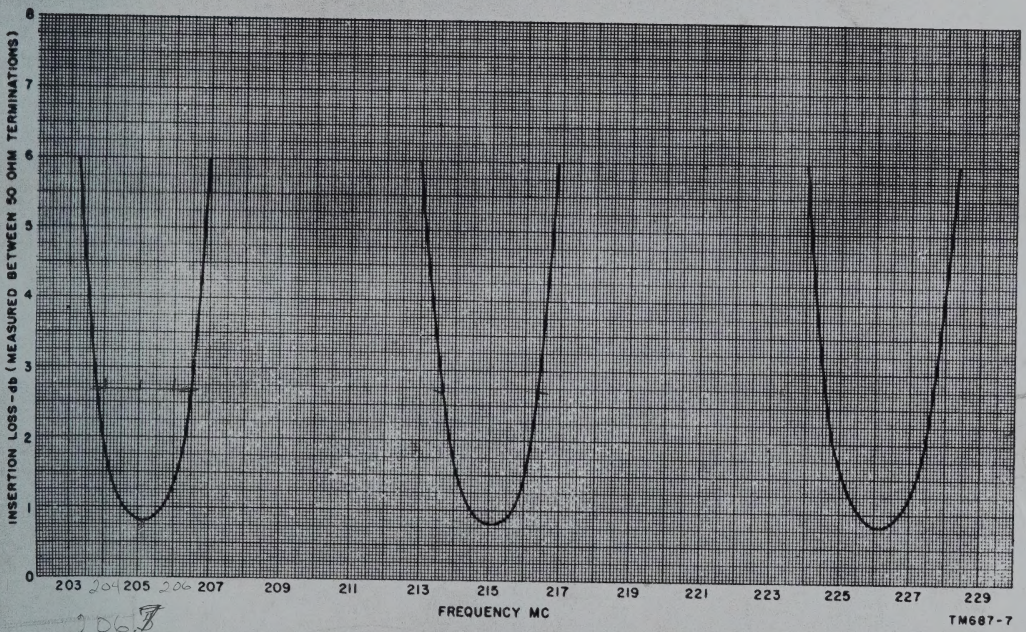


Figure 53. Representative characteristics of band-pass filters.

206.7
203.7
3.0

2.8 mHz 2.6 MHz

INSERTION LOSS — db (MEASURED BETWEEN 50 OHM TERMINATIONS)

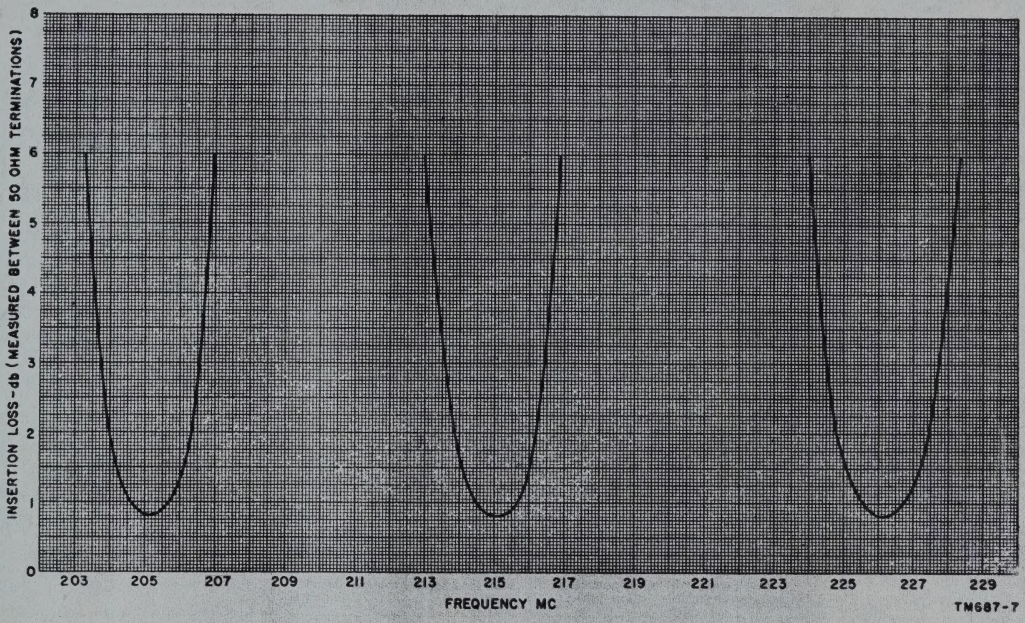


Figure 53. Representative characteristics of band-pass filters.

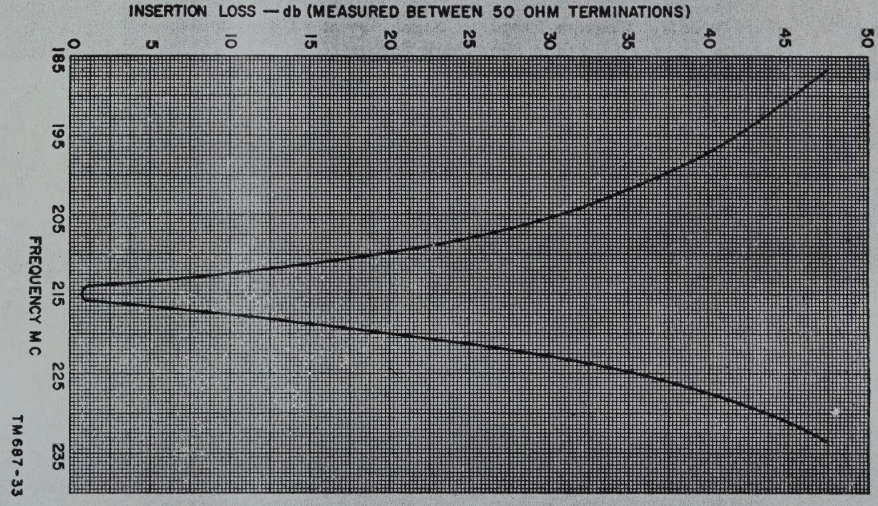


Figure 54. Characteristics of Band-Pass Filter F-197/U.